FOREST PEST CONDITIONS IN CALIFORNIA - 1978

A PUBLICATION OF THE CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL

THE CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL was founded in 1951. Its membership is open to public and private forest managers, foresters, entomologists, pathologists, zoologists, and others interested in the protection of forests from damage caused by animals, insects, and diseases. Its objectives are to establish, maintain, and improve communication among individuals -- managers, administrators, and researchers -- who are concerned with these problems. This objective is accomplished by four actions:

1. Coordination of detection reporting and compilation of pest damage information.

2. Evaluation of pest conditions.

3. Pest control recommendations made to forest managing agencies and owners.

4. Review of policy, legal, and research aspects of forest pest control, and submission of recommendation thereon to appropriate authorities.

The State Board of Forestry recognizes the Council as an advisory body in forest pest protection. The Council is a participating member in the Western Forest Pest Committee of the Western Forestry Conservation Association.

THIS REPORT, FOREST PEST CONDITIONS IN CALIFORNIA - 1978, is compiled for public and private forest land managers to keep them informed of pest conditions on forested land in California, and as an historical record of pest trends and occurrences. The report is based largely on information provided by the Statewide Cooperative Forest Pest Detection Survey; in 1978, 140 reports were received: 65 for insect pests, 40 for diseases, and 35 for animal pests.

The report was prepared by the Forest Service in cooperation with other member organizations of the Council. It was duplicated and distributed by the California Department of Forestry.

COVER PHOTO. Reduction of needle length of ponderosa pine caused by the drought in California, 1975 through 1977, and growth recovery in 1978.

Sacramento January 1979

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1978-1979

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HIGHLIGHTS OF PEST CONDITIONS - 1978

STATUS OF INSECT PESTS. The severe drought (precipitation 35% of normal) that occurred from 1975 through 1977 was ended by abundant moisture (100 to 340% of normal) during the winter and early spring of 1977-1978. However, the protracted debilitating effect (cover photo) on forest vigor was manifest in 1978 by a continuation from 1977 of a high level of tree mortality (Table 1) associated with bark beetle activity.

Table 1. Tree mortality from the 1975 to 1977 drought on the 6.3 million acres of commercial forest land on the 12 National Forests of northern California, 1978

Drought Period	Trees Killed	S.B.F. Volume of Killed Trees
1975 to 1976	2.0 MM	1.9 MMM
1976 to 1977	4.5 MM	1.2 MMM
1977 to 1978	5.8 MM	5.5 MMM

In general, the location of concentrated tree mortality shifted in 1978. In 1977, the low elevation pine from the central Sierra Nevada north into the southern Cascade Range was the forest type most severely affected by the combined effects of drought, disease, adverse site and stand conditions and bark beetles. Tree mortality in this type subsided or remained static at a high level in 1978; however, pronounced increases in pine and fir mortality occurred in the mid-to-upper elevation mixed conifer and fir types, particularly from the northern Sierra Nevada south to the Tehachapi Mountains.

Tree mortality was associated with concentration of beetle attacks on weakened or low vigor trees or stands resulting from the drought and adverse growing conditions - site factors (shallow soils, steep slopes on south to west facing aspects), stand conditions (over-stocking, over-age), diseases (mistletoes, root decays), man-caused disturbances (recent logging, road and home construction and thinning with inadequate slash disposal). These observations reemphasize the opportunities for forest managers to prevent and reduce tree mortality caused by bark beetles and other cambium feeders by integrating sound pest management strategies with silvicultural prescriptions designed to improve or maintain the thrift and vigor of forest stands.

Top-killing of ponderosa pine by engraver beetles dropped markedly in 1978, and they declined as a precursor to attack by the western pine beetle. To a large extent, the lower boles of trees previously top-killed in 1977 were attacked, as expected, by western pine beetles early in the year.

Assuming northern California receives normal to near normal precipitation this coming winter and spring, tree mortality might well be expected to decline in 1979 as the forest continues its recovery from the stress of the recent drought. Precipitation in any amount significantly less than normal would only tend to prolong the high level of tree mortality. Regardless of what the winter and spring months bring in the way of moisture, all forest land managers are again urged to maintain or increase salvage programs emphasizing prompt removal of dying and dead trees for sanitation purposes and to optimize recovery of volume and grade.

For the second consecutive year, population densities of the Douglas-fir tussock moth showed slight increases at some locations; yet overall, the population levels remain low. Extensive localized tree mortality is reported from Yosemite National Park as a result of heavy feeding by the lodgepole needleminer. The San Bernardino Mountains remain relatively free of bark beetles. However, a fifth consecutive year of severe defoliation of oaks by the fruittree leafroller occurred over some 10,000 acres near Lake Gregory.

Reports indicate that grasshoppers have caused a major amount of damage to young trees in 1978. Douglas-fir apparently sustained the greatest loss of seed crop due to cone and seed insects.

STATUS OF DISEASES. Sugar pine saplings previously considered resistant to white pine blister rust exhibited signs and symptoms of infection originating in 1976 and perhaps in 1975. Root rots, Heterobasidion annosum (Fomes annosus), Verticicladiella wagenerii and Armillaria mellea, frequently were associated with tree mortality along with bark beetles. Dwarf mistletoes were found associated with large volume losses during the 1978 drought survey. Fusarium oxysporum continued to be the major disease problem in forest nurseries. Ground surveys on the Sierra and Sequoia National Forests found that ozone injury symptoms on pines were common but ozone was not causing excessive injury.

In 1978, Federal, State and local government agencies implemented a cooperative Dutch elm disease control demonstration project and public information outreach program that is expected to last five years.

STATUS OF ANIMAL PESTS. The deer, pocket gopher and porcupine continue to be the three mammal species causing the most significant damage to commercial conifer forests.

STATUS AND CONTROL OF INSECT PESTS

DOUGLAS-FIR TUSSOCK MOTH, Orgyia pseudotsugata. Douglas-fir tussock moth (Figure 1) larval populations in Modoc County sample plots declined slightly from 1977 levels and remain very low. A moderate increase (maximum of approximately 5 early instar larvae/1000 sq in of foliage at Iron Mtn.) occurred for the second straight year in El Dorado County where: (a) egg masses were found in some areas in the fall of 1978, (b) catches of adult male moths in pheromone traps increased relative to 1977, and (c) some defoliation was visible from the ground. Calaveras and Tuolumne Counties also showed slight increases in larval population densities over 1977, but were generally lower than in El Dorado County. The presence of larvae and minor feeding damage were reported from the Camp Nelson area in Tulare County, but no evidence of activity was reported from historically active areas around Burney, Shasta County.

Figure 1. The Douglas-fir Tussock Moth. Adult male (above); adult females (below) before (r) and after (l) laying eggs.

LODGEPOLE PINE NEEDLEMINER, Coleotechnites milleri. High populations continue to defoliate approximately 100,000 acres of lodgepole forests in the Merced and Tuolumne River drainages in Yosemite National Park. Extensive tree mortality was observed in Lyell Canyon and north of Tuolumne Meadows.

SILVER SPOTTED TIGER MOTH, Halisidota argentata. Low populations were reported along the periphery of the 1977 outbreak area near Eden Valley - Elk Creek in Mendocino County. Considerable mortality to Sargent Cypress was observed in the infestation area, but little additional damage to the remaining stands was observed.

WHITE FIR SAWFLY, Neodiprion spp. No serious infestations of white fir sawflies were reported in 1978. Noticeable populations were reported from Bacon Rind Campground, Siskiyou County; Cottonwood Springs, Modoc County; and Baltic Ridge, El Dorado County.

BUDWORMS, Choristoneura spp. A population survey covering 27 points in Siskiyou and Modoc Counties indicated that populations were generally low, but at Cottonwood Springs, Modoc County, fairly high populations were noted in a young white fir stand that appears to have been repeatedly defoliated. Both C. viridis and larvae of what may be C. occidentalis were encountered, suggesting possible changes in the reported ranges of the species involved.

TENT CATERPILLAR, Malacosoma sp. From 1973 to 1977, Malacosoma sp. (prob. the Great Basin tent caterpillar, M. californicum fragile) has been reported causing defoliation of approximately 38,000 acres of bitterbrush in the Mono Lake - Mammoth Lake region of Inyo County. Populations may be declining as only one active infestation was reported in 1978 (West Portal area) and no new egg masses were found in the fall of 1978.

FRUITTREE LEAFROLLER, Archips argyrospilus. Populations have increased in the Lake Gregory area of southern California since 1974, defoliating fruit trees, oaks and other ornamental hardwoods. Populations were higher in 1978 than 1977.

JEFFREY PINE NEEDLEMINER, Coleotechnites sp. nr. milleri. The Jeffrey pine needleminer infestation in San Bernardino County remained static in 1978. No newly infested areas were reported and populations appeared to decline in some areas.

WESTERN PINE BEETLE, Dendroctonus brevicomis. Tree killing by western pine beetles (Figure 2) continued at a high level in 1978. Low elevation pine that was top-killed by pine engraver beetles in 1977 was utilized by emerging broods early in 1978. The most noticeable increase in tree mortality occurred in the area from the central Sierra Nevada south to the Tehachapi Mountains. Some of the larger new areas showing concentrated tree killing were French Creek, Butte County; Deer Creek, Tehama County; North Canyon Road and near the Auburn Dam Project, El Dorado County; Mi-Wuk Village, Tuolumne County; Yosemite Valley, Yosemite National Park; and Bass Lake, Madera County. Tree mortality dropped appreciably in northwest California.
Whether in new or persistent infestation centers, over-stocking, poor site and dwarf mistletoe have repeatedly been observed as major factors predisposing the trees to attack by the beetles.

Figure 2. Western Pine Beetle -- adult.

PINE ENGRAVER BEETLES, Ips spp. Damage to pine by engraver beetles showed a sharp drop in 1978 from the extremely high levels of activity experienced in the low elevation pine type in 1977. Such a sharp drop might well suggest the forest has at least partially recovered from the drought.

MOUNTAIN PINE BEETLE, Dendroctonus ponderosae. Mountain pine beetle activity continued at a high level throughout northern California in both old and young-growth sugar pine, but no specific areas with unusually heavy tree mortality were reported. Forest managers continued to express concern over the amount of mortality visible in apparently thrifty, vigorous young sugar pine growing on good quality sites. No reason other than drought stress coupled with high stocking levels has been advanced to explain why mountain

pine beetles plus other bole-infesting cambium feeders have contributed to the death of these types of trees over the past two years.

JEFFREY PINE BEETLE, Dendroctonus jeffreyi. Although this beetle seldom was found at any of the drought survey plots, it was active throughout the range of its host. Lethal attacks in east side pine frequently were in conjunction with attacks by the pine engraver, Ips pini, which often appeared to be more of a mortality factor than D. jeffreyi.

FIR ENGRAVER, Scolytus ventralis. Mortality in both young and old-growth true fir rose sharply in both the mixed conifer type and the pure fir type from Modoc and Siskiyou Counties southward to Fresno County. Plumas, Sierra, Nevada and Placer Counties were most severely affected. Much of the mortality was attributed solely to the fir engraver although engraver broods were frequently mixed with broods of Melanophila sp. and/or Tetropium sp. Overstocking, decadence, root disease, mistletoe, adverse site properties and drought interacting in various combinations are judged to have triggered the tremendous upsurge in mortality beginning in late 1977.

RED TURPENTINE BEETLE, Dendroctonus valens. For the second consecutive year, the red turpentine beetle appeared much more aggressive than what is usually expected. Not infrequently, abundant broods, particularly in sugar pine, were found at heights of five to six feet above ground line and on occasion were considered to have contributed to the death of drought stressed trees.

FLATHEADED AND ROUNDHEADED BORERS, Melanophila and Tetropium spp. The California flatheaded borer, M. california, played a major role in the death of ponderosa and sugar pine in northern California (Table 2). Examination of dead and dying pines often showed the cambium layer to be well utilized strictly by flatheads; but, it was not unusual to find flatheads cohabiting with various species of Dendroctonus spp. and Ips spp. also.

The roundheaded fir borer, Tetropium abietis, was commonly found in dead and dying true fir in 1978. In white fir it was often mixed with the fir engraver, but in red fir it was generally found by itself.

The fir flatheaded borer, M. drummondi, was occasionally found in true fir, but was relatively common in Douglas-fir. Douglas-fir mortality in northwest California increased from 1977 to about the 1975-1976 level of mortality. An evaluation of the accelerated mortality in the area is continuing, but some of the obvious site and stand factors common to much of the area are overmature Douglas-fir on steep rocky slopes and severe hardwood competition.

INSECTS DAMAGING PLANTATIONS AND YOUNG TREES. Grasshoppers were reported as causing a major amount of damage to young trees. Extensive grasshopper damage to newly planted pines was noted near Castaic Lake in Los Angeles County and in the Hog Burn in Siskiyou County. The Douglas-fir reproduction weevil, Cylindrocopturus furnissi, killed about one-third of the reproduction in several cut blocks in Trinity County. The pine resin midge, Cecidomyia piniinopis, was generally at low levels during 1978, but at one ponderosa pine plantation in Siskiyou County the majority of the trees showed some damage. An outbreak of spider mites on 1,000 newly grafted ponderosa pine

at the Forest Service Tree Improvement Center at Chico in Butte County was treated with Dicofol formulation.

CONE AND SEED INSECTS. Examination of cones passing through the Placerville Nursery in the fall of 1978 indicated that the fir coneworm, Dioryctria abietivorella, and the Douglas-fir cone midge, Contarinia oregonensis, were the most severe pests of Douglas-fir cones. Losses were frequently unacceptably high.

Seedworms, Laspeyresia spp., the fir coneworm and the ponderosa pine coneborer, Eucosma ponderosa, damaged the pine cones examined. Seed losses were low as cones infrequently contained more than two seedworm larvae, and many were free of any insect. However, nursery personnel reported that a few collections were heavily damaged by insects.

Seed analysis showed heavy damage in 35 Douglas-fir cones randomly selected from 7 plots collected from the Badger Hill breeding Arboretum. Seed loss ranged from 10 to 100% ($\bar{x}$ = 56%) of the potential seed crop and totaled 83% of the actual seed crop. The fir coneworm and the Douglas-fir cone midge were responsible for most of the loss with a minor amount of seed destroyed by the seedbug, Leptoglossus occidentalis.

The fir coneworm caused minor damage in pine cones from Badger Hill, but these cones often contained a high proportion of aborted and rudimentary seeds. This absence of normal seed development was the primary cause of poor seed yields in the cones examined. The indirect effect of insect damage on seed development remains an enigma not yet touched by forestry research.

Douglas-fir cones near Pollock Pines, El Dorado County, and French Gulch, Shasta County, were heavily attacked by the Douglas-fir cone midge. The Douglas-fir cone moth, Barbara colfaxiana also was present at both locations. Infestations of Laspeyresia spp. and D. abietivorella in ponderosa pine were light.

Other cone and seed insects were reported less frequently. The sugar pine and ponderosa pine cone beetles, Conophthorus lambertiana and C. ponderosae, infested cone crops at scattered locations throughout the host range in California. The incense-cedar tip moth, Argyresthis libocedrella, lightly damaged cone crops of incense-cedar near McCloud, Siskiyou County, and on the Descanso District, Cleveland National Forest. The pine cone resin midge, Asynapta keeni, was reported as abundant in collections of ponderosa pine cones on the Almanor District, Eldorado National Forest.

Table 2. Insects of limited importance in the forests of California - 1978.

Names		Examined or Reported		
Scientific	Common	Hosts[1]	Locality	Remarks
Scythropus sp.	Pine needle weevil	PP, CP KP, MP JP	Throughout California	Commonly reported.
Cynips douglasii	Gall wasp	Oak	Kern Co., Fresno Co.	Common.
Chionaspis pinifoliae	Pine needle	LP	Mono Co.	Overmature hosts.
Dioryctria sp.		PP, SP DF SP	Butte Co.	Bud damage in progeny test area. Callus tissue of grafted seedlings.
Eucosma sonomana	western pine-shoot borer	PP, JP LP	Throughout northern California.	Increasing in importance as reforestation accelerates.
Eriophyes parapopuli		QA	Mono Co.	
Semanotus sp.		IC	Nevada Co.	
Coloradia pandora	Pandora moth	JP	Kern Co.	Multiple sightings.
Leptocoris trivittatus	Box elder bug	Maple	Los Angeles Co.	On trees apparently damaged by air pollution.
Scolytus unispinosus	Douglas-fir engraver	DF	Humboldt Co., El Dorado Co., Del Norte Co.	Primarily top-kill.
Acraspis sp.	Cicada	Oak DF	Madera Co. Plumas Co.	Localized
Neodiprion sp.	Sawfly	PP, DF	Siskiyou Co.	Small trees.

1. PP = Ponderosa pine
   CP = Coulter pine
   KP = Knobcone pine
   MP = Monterey pine
   JP = Jeffrey pine
   LP = Lodgepole pine
   SP = Sugar pine
   DF = Douglas-fir
   QA = Quaking aspen
   IC = Incense-cedar

TABLE 3

ACTIONS RECOMMENDED - 1978

NORTHERN CALIFORNIA COMMERCIAL AND RECREATIONAL FORESTS

INFESTATION AREA	ACREAGE (Est.)	COUNTY	INSECT[1]	HOST[2]	RECOMMENDED ACTION
BARK BEETLES					
Northern California	--	--	Db, Dj, Dp, Dps, Ips, Mc, Md, Sv	Conifers	Stand Management, Maintenance Control
DEFOLIATORS					
Statewide	--	--	Gm	O	Surveillance
Statewide	--	--	Op	WF	Surveillance
PLANTATIONS AND SEED ORCHARDS					
Seed Orchards	100	Northern California	Da	PP, DF, SP	Surveillance, Treat new grafts with Lindane
Plantations	--	Statewide	Eu, Zh, Cp, Rz	Conifers	Surveillance, Evaluation
STATE AND NATIONAL PARKS					
State and National Parks	--	--	Dj, Db, Dp	JP, PP, SP, LP	Thin, Prescribe burn, Hazard Tree Removal
Yosemite National Park	100,000	Tuolumne	Cm	LP	Surveillance
SOUTHERN CALIFORNIA RECREATION FORESTS					
Southern California	--	San Bernardino	Dp, Db, Ips, Dj	PP, CP, JP, WF, SP	Stand Management, Maintenance Control
		Los Angeles	Mc, Dv, Sv		
		Riverside			
		Ventura			
		Santa Barbara			
Snow Valley-Big Bear-Santa Ana	3,000	San Bernardino	C sp.	JP	Evaluation
Lake Gregory	10,000	San Bernardino	Aa	O	Surveillance, Evaluation

1. PEST ABBREVIATIONS

Aa	- Fruittree Leafroller
C sp.	- Jeffrey pine needle miner
Cm	- Lodgepole Needleminer
Cpp	- Pine Resin Midge
Da	- Fire coneworm
Db	- Western pine beetle
Dj	- Jeffrey pine beetle
Dp	- Mountain pine beetle
Dps	- Douglas-fir beetle
Dv	- Red turpentine beetle
Eu	- Eucosma
Gm	- Gypsy moth
Ips	- Pine ips
Mc	- California flatheaded borer
Mc	- Flatheaded fir borer
Op	- Douglas-fir tussock moth
Rz	- Ponderosa pine tip moth
Sv	- Fir engraver beetle
Zh	- Needle-sheath miner

2. HOST ABBREVIATIONS

CP	- Coulter pine
DF	- Douglas-fir
JP	- Jeffrey pine
LP	- Lodgepole pine
MP	- Montery pine
O	- Oak
PP	- Ponderosa pine
SP	- Sugar pine
WF	- White fir

WHITE PINE BLISTER RUST, Cronartium ribicola. Observations made during the summer of 1978 indicated that blister rust infection of sugar pines was unusually heavy in 1976, and perhaps in 1975. The percentage of sugar pines infected in a plantation on the Plumas National Forest increased from a previous level of 15% up to 75%. The rust increase in several other Sierra Nevada plantations that were examined was less dramatic, but cankers originating in 1975 and 1976 were abundant. A more thorough assessment of the level of infection and damage will be made beginning in 1979 when the 1976 infections will be easier to detect.

The spring examination at the rust resistant sugar pine test site near Happy Camp indicated that the 1976 infection was also unusually heavy at that location. Some 5-10 year old trees that were considered resistant to the rust became infected for the first time. The reason for this infection of previously resistant sugar pines, and the consequences of it, are not yet fully known.

ANNOSUS ROOT ROT, Heterobasidion annosum (Fomes annosus). Annosus root rot continues to be a serious and frequent cause of mortality and failure in pine and fir types. (Figure 3) It is especially damaging in recreation sites in southern California and in the east-side pine type.

Figure 3. Center of Heterobasidion annosum (Fomes annosus), Eldorado National Forest.

BLACK STAIN ROOT DISEASE, Verticicladiella wagenerii. Continued damage to ponderosa pine on McCloud Flats (Shasta-Trinity NF) and at Georgetown Divide (Eldorado NF) caused by a black stain/bark beetle complex was evident in 1978. In an attempt to control this problem, the silvicultural prescription for McCloud Flats had included identifying disease centers, cutting buffer strips around centers, and planting resistant species within the diseased areas.

DUTCH ELM DISEASE, Ceratocystis ulmi. A cooperative Dutch elm disease control demonstration project, involving Federal, State, and local agencies and funding, was initiated in late 1977. The Californa Department of Food and Agriculture is responsible for carrying out the program's objective, which is to demonstrate that Dutch elm disease can be eradicated or controlled to less than one percent annual loss within a five-year period by intensive survey and aggressive sanitation. San Mateo County was chosen for the demonstration area and had its first report of the disease in 1977. This area contains over 58,000 single-family residences and an estimated 34,000 threatened elms. Integrated with the project is a cooperatively funded statewide program of education and communication activities directed by the University of California Cooperative Extension.

NURSERY DISEASES. Fusarium oxysporum continued to be the major disease problem in the State and Federal forest nurseries in California. F. oxysporum killed 44% of the 1-0 sugar pine and 46% of the red fir at Magalia Nursery. It also caused losses in Jeffrey and Scots pine, giant sequoia and Russian olive. At Placerville Nursery, 7% of the 1-0 sugar pine were killed by F. oxysporum. Ben Lomond Nursery had scattered losses in 1-0 Douglas-fir, Coulter and Monterey pine.

The only other disease causing observable losses in the nurseries was Pythium sp. Pythium caused losses in potted 2-0 sugar pine and rooted Douglas-fir at the Chico Tree Improvement Center. It also caused some losses in 10 Jeffrey and ponderosa pine and white fir at Magalia Nursery.

At Placerville Nursery approximately 3 MM 1-0 Jeffrey and ponderosa pine will not be lifted because they are too small for outplanting. This stunting was associated with the lack of mycorrhizae, which affected the growth of the seedlings during their first growing season.

Seven chemicals were tested to determine their effectiveness in reducing Fusarium oxysporum caused losses in sugar pine and Douglas-fir at Placerville and Humboldt Nurseries. The data has been collected and is being analyzed.

OTHER DISEASES. A bole canker of unknown cause on red and white fir was detected during 1977 (Figure 4). Concern over breakoffs at cankers following thinning operations prompted a survey during 1978 to determine the prevalence and distribution of the canker in densely-stocked young fir stands in the northern Sierra and Cascade Ranges. The canker was present in all stands examined in Shasta, Plumas and Placer Counties, and was relatively common in some of the stands. In El Dorado, Amador, Calaveras, and Tuolumne Counties, the canker was apparently absent from some stands and, in the stands where it was present, it was less common than in the stands examined in the northern counties. University of California pathologists isolated fungi from the cankers, and olive trees have been innoculated with the fungi, but it will be a year or more before pathogenicity of the fungi can be determined. Several insects were found associated with the fir cankers. Pitch moth, Vespamima sp., were frequently found boring in the cambial region at the edges of cankers and a longhorned borer, Strictoleptura canadensis, was recovered from the dead wood behind a canker. Woodborers and decay in the area of cankers are thought to contribute to the likelihood of stem breakage.

Figure 4. Canker of unknown cause on a small red fir east of Mt. Shasta.

TABLE 4

FOREST DISEASES REPORTED - 1978

AGENT	HOST[1]	COUNTY
Salt damage	AC	Contra Costa
Unknown abiotic	PP	Fresno
Dermea canker	DF	Siskiyou
Phomopsis gall	LO	San Bernardino
Dothistroma pini	MP	Humboldt
Lophodermium pinastri	MP	Humboldt
Lophodermium pinastri	SP	Sonoma
Heterobasidion annosum (Fomes annosus)	PP	Amador
Heterobasidion annosum	IC	Fresno
Weather, abiotic	CP, KP	Los Angeles
	IC, JP	
Cronartium limb rust	JP	San Bernardino
Atropillis canker	LP	El Dorado
Nursery Diseases		
Alternia sp.	SP, PP	Butte
Fusarium oxysporum	SP, RF, WF, JP ScP, R, RO, PP	Butte
	SP	El Dorado
	DF, CP, MP	Santa Cruz
Pythium sp.	SP, DF	Butte
Rhizotonia sp.	GS	Butte

HOST ABBREVIATIONS

AC = Arizona cypress
CP = Coulter pine
DF = Douglas-fir
GS = Giant Sequoia
IC = Incense cedar
JP = Jeffrey pine
KP = Knobcone pine
LO = Live oak
LP = Lodgepole pine
MP = Montery pine
PP = Ponderosa pine
R = Redwood
RF = Red fir
RO = Russian olive
ScP= Scots pine
SP = Sugar pine
WF = White fir

SURVEYS AND EVALUATIONS

DROUGHT. For the second successive year a mortality survey was conducted on the commercial forest land of the 12 northern National Forests of California to assess the impact of the drought of 1975-1977. A total of 168 plots of 280 acres each were randomly chosen, aerially photographed and interpreted for trees that died between June 1977 and June 1978. A sample of 240 mortality centers were randomly selected from 50 of these plots and ground checked during the late summer and early fall of 1978.

An estimated 5.8 million trees containing 5.5 billion bd ft died on 6.3 million acres of commercial forest land (Table 1). The greatest volume loss occurred in the mixed conifer type (76% of total loss) and on sites A, 1 and 2 (87%). This is similar to results of 1976 to 1977. Ponderosa pine and white fir were the tree species most severely affected (74% of the volume loss).

Insect and disease pests were implicated in 99% of the tree losses and appeared to play two main roles in contributing to the mortality. Endemic pests such as root diseases and mistletoes predisposed their hosts to earlier and more severe drought stress, while the more aggressive pests such as bark beetles and flatheaded borers killed the weakened, stressed trees.

SAN BERNARDINO MOUNTAINS. Data were collected for the third and final year of a survey to determine the level and causes of tree mortality on the San Bernardino National Forest. Results of the survey, available in 1979, will be used to formulate strategies to minimize the damage.

Data were collected for the second year on dead and dying trees on private lands in the Mountains. Results will be used to advise landowners on means to prevent tree loss.

AIR POLLUTION. Ozone injury on ponderosa and Jeffrey pines was evaluated on National Forest trend plots in Fresno and Tulare Counties. Although symptoms were more prevalent in 1978 than in 1977, injury ratings have not shown any consistent upward or downward trends in the level of injury since the plots were established in 1974.

The Forest Service monitored ozone concentrations at three sites in Tulare County -- Whitaker Forest, Mountain Home State Forest, and Peppermint Heliport -- and at one site in Kern County -- Greenhorn Summit Guard Station. Although analysis of the data is incomplete, the Federal and State Standards were frequently exceeded during the summer at all four sites. At Whitaker Forest, which has been monitored continuously since July 1976, daily maximum hourly averages were often in the range of 11 to 16 parts per hundred million ozone.

The Forest Service completed an ozone injury ground survey on areas of the Sierra and Sequoia National Forests between 4000 and 8000 ft. A total of 242 plots (10 trees/plot) were established along the western slopes of the Sierra Nevada from Madera County south to Kern County. About 19% of all the ponderosa and Jeffrey pines examined during the survey showed some degree of chlorotic mottle. The worst injury detected was classified as "moderate" and accounted for less than 6% of the survey plots. In summary, ozone symptoms were commonly found in much of the southern Sierras, but ozone is not currently causing moderate or worse injury on a forest-wide basis. Ozone-sensitive trees will most likely suffer continued injury as past seasonal ozone levels reoccur.

COMPARTMENT INVENTORY AND ANALYSIS/PEST DAMAGE INVENTORY (CIA-PDI). The FIDM Staff and personnel of the San Bernardino National Forest cooperated for the second year in testing a method of obtaining more accurate and complete estimates of pest-related losses as a part of compartment examination procedures. The objective of the test was to provide silviculturists with information they can use to integrate pest management procedures into the prescription writing process.

Four compartments were inventoried, with a total acreage in timber of about 32,000 acres. Field crews were trained in identification and evaluation of pests and were provided with forms which complimented the standard CIA plot form; these forms were filled out whenever pests were encountered on the CIA prism plots.

Evaluation is done as simply as possible. The first information used is incidence, the number of times a pest complex occurs on the prism points. If any pests are encountered frequently, then additional information on stand and tree characteristics can be obtained in order to adjust the prescription.

BIOLOGICAL EVALUATIONS. The following biological evaluations (Table 5) of forest pest problems in California were conducted by the USDA Forest Service Insect and Disease Management Staff in FY '78. These evaluations include brief descriptions of the pest problems and management alternatives available to the forest manager. A limited number are available for forest managers on request. Send these requests care of Wilfred L. Freeman, FIDM, USDA Forest Service, 630 Sansome Street, San Francisco, California 94111.

TABLE 5

BIOLOGICAL EVALUATIONS

Evaluation Number	Area Evaluated	Host Species	Pest Involved
78-01	North Fork Compartment, San Jacinto R.D., San Bernardino N.F.	CP, JP[1]	Am[2]
78-02	Yosemite Valley, Yosemite N.P.	PP, IC	Fa
78-03	Fire Cracker and Red Mtn. Timber Sales, Shasta-Trinity N.F.	PP, SP	Db, Dp, Ips
78-04	Cooper Gulch Sale Area, Shasta-Trinity N.F.	PP, SP	Db, Ips
78-05	South Fork of the Feather River, Plumas N.F.	PP	Db, Ips
78-06	French Creek, Oroville R.D., Plumas N.F.	PP, SP	Db
78-07	Balky Horse, Baldwin Lake, Big Bear R.D., San Bernardino N.F.		Vw
78-08	Cade Mtn., Kelsey Creek, Scott Bar Mtn., Deep Creek, Idlewild Camp, Klamath N.F.	PP, SP	Db, Dp
78-09	Deer Mtn. and Pomeroy Creek, Goosenest R.D., Klamath N.F.	PP	Fa, Db, Ips, Dv, Mc
78-10	National Forests north of the Tehachapi Mtns. (Drought Survey)	All conifer spp.	Major insects and diseases

TABLE 5 - continued

BIOLOGICAL EVALUATIONS

Evaluation Number	Area Evaluated	Host Species	Pest Involved
78-11	Sequoia & Kings Canyon N.P.	SP	Br
78-12	Crystal Lake Recreation Area, Angeles N.F.	PP, JP SP, IC WF, BDF	Dm, Tm
78-13	Deanes Valley, Plumas N.F.	PP, SP, WF	Db, Dp, Sv, Md, Dv
78-14	Engle Bright Recreation Area, Marysville, CA	PP, DP, BO, LO, PM	Db, Dv, Ips, Dm, Tm
78-15	Isabella Lake Recreation Area	AP, DP, AC, LO	Fa, Dm, Tm
78-16	Mt. Pinos R.D., Los Padres N.F.	JP, PNP, WF, J	Fa, Mc, Tm, Lr
78-17	Sequoia & Kings Canyon N.P.	SP, IC PP, JP WF	Fa, Tm, Sv, Am, Et, Hr
78-18	San Bernardino N.F.	JP, WF	Dm, Dj, Mc, Ips, Fa, Am, Vw, Sv, Ta, Tm
78-19	Humboldt, Ben Lomond, Placerville & Magalia Nurseries	SP, PP, DF, CP, WF, RF	Fusarium Oxysporum
78-20	Chico Tree Improvement Center	PP	Da
78-21	Mule Helicopter Sale, Shasta-Trinity N.F.	PP, SP	Db, Dp, Mc, Ips
78-22	Deer Creek, Almanor R.D., Lassen N.F.	PP, SP	Db, Ips

TABLE 5 - continued

BIOLOGICAL EVALUATIONS

Evaluation Number	Area Evaluated	Host Species	Pest Involved
78-23	South Fork of the American River, Eldorado N.F.	PP	Db, Ips
78-24	Deer Mtn., Klamath N.F.	PP	Db, Dv, Ips
78-25	San Bernardino N.F.	JP	C sp.
78-26	Eden Valley	Cypress	Ha
78-27	Rubicon River Roadless Area, Eldorado N.F.	PP, SP, IC, WF, BO	Dv, Db, Dp, Mc, Am, Dm, Sv
78-28	Chico Tree Improvement Center	PP	Spider mites
78-29 (Refer to 78-27)	Peavine Research Study Area, Eldorado N.F.	PP, SP, IC, WF, BO	Dv, Db, Dp, Mc, Ips, Sv, Dm, Am
78-30	McCloud Flats, Shasta-Trinity N.F.	PP	Vw, Db
78-31	Soapstone Plantation, Plumas N.F.	PP, SP	Br

1. Host Abbreviations

AC = Arizona cypress

AP = Aleppo pine

BDF = Big cone Douglas-fir

BO = Black oak

CP = Coulter pine

DF = Douglas-fir

DP = Digger pine

IC = Incense-cedar

J = Juniper

JP = Jeffrey pine

LO = Live oak

PM = Pacific madrone

PNP = Pinyon pine

PP = Ponderosa pine

SP = Sugar pine

WF = White fir

2. Pest Abbreviations

Am = Shoestring root rot

Br = Blister rust

C sp = Jeffrey pine needle miner

Da = Fir coneworm

Db = Western pine beetle

Dj = Jeffrey pine beetle

Dm = Dwarf mistletoe

Dp = Mountain pine beetle

Db = Red turpentine beetle

Et = Indian paint fungus

Fa = Annosus root rot

Ha = Silver spotted tiger moth

Hr = Heart rot

Ips = pine engravers

Lr = Limb rust

Mc = California flatheaded borer

Md = Fir flatheaded borer

Sv = Fir engraver

Ta = Fir roundheaded borer

Tm = True mistletoe

Vw = Black stain root disease

STATUS AND CONTROL OF ANIMAL PESTS

DEER. Deer damage to coniferous seedlings and saplings was serious and widespread, especially in plantations, in the major northern forests and in areas of the Sierra Nevada. Increased damage occurred in the northern coast range and in the Klamath Mountains. No significant problems were reported from the southern coast range, the southern, interior mountains or the national forests of the central Sierra Nevada. The extent of the problem is indicated by the following reports: "deer damage on 75 percent of all planted trees"; "deer are a critical factor in establishment of new stands"; and "90 percent of all Douglas-fir seedlings are cropped at least once." There was increased use of Vexar tubes for control and there was limited employment of hunting and repellents.

POCKET GOPHER. Pocket gopher damage in one to fifteen year old plantations of pines, true firs and Douglas-fir continued, largely unabated, in most timber areas. Increased damage occurred in Siskiyou County and in the Mendocino, Tahoe, Eldorado and Los Padres National Forests. Machine or hand baiting with strychnine-treated oats was the major control measure.

PORCUPINE. Porcupine damage in plantations and natural stands was common, widely scattered and very variable in seriousness in the northern, inland forests and the Sierra Nevada. Increased damage occurred in the Klamath Mountains and in the northern Sierra Nevada. Damage was primarily on ponderosa pine with limited damage on Jeffrey and sugar pines in the northern Sierra Nevada and light damage on Douglas-fir in Del Norte and Humboldt Counties. A small amount of control was attempted with strychnine-treated salt blocks.

OTHER ANIMALS. The animals listed here caused damage in the counties or regions noted. Damage was severe in some areas but it was generally not widespread.

SPECIES	COUNTY OR REGION
Beaver	Del Norte, Klamath Mountains
Black Bear	Del Norte, Humboldt, Mendocino, Tehama
Dusky-Footed Woodrat	Del Norte, Humboldt, Mendocino
Elk	Del Norte, Humboldt (northern)
Meadow Mouse	Shasta, Marin, Sonoma, Napa, Colusa, Humboldt
Mountain Beaver	Del Norte, Humboldt
Rabbits	Humboldt, Mendocino, Sierra, Nevada, Yuba, Shasta, Trinity, Southern Coast Range
Small Seed-eating Mammals	Del Norte, Humboldt, Siskiyou, Shasta, Marin, Sonoma, Napa, Colusa, Yuba, Plumas, Butte, Sierra
Tree Squirrels	Del Norte, Humboldt, Mendocino, Lake, Siskiyou, Tehama, Placer, El Dorado, San Bernardino, Riverside
Domestic Stock	Mendocino, Tehama, Glenn, Colusa, Lake, El Dorado, Placer, Sierra, Tuolumne, Siskiyou, Humboldt
California Ground Squirrel	Southern coast range, southern Sierra Nevada

KNOW YOUR FOREST DISEASES

MYCORRHIZAE

Almost all vascular plants growing in the forest community in the temperate zones of the world have roots whose tips are infected with beneficial fungi. These infected roots are called mycorrhizae (fungus roots).

What are mycorrhizae? Mycorrhizae are a symbiotic association of the mycelium of a fungus with the roots of a seed plant in which the fungal hyphae either form an interwoven mass infesting the cortex of root tips or penetrate the cortical cells of the root tips.

TYPES OF MYCORRHIZAE

There are two major types of mycorrhizae based on the arrangement of the mycorrhizal hyphae in root tissue of the host plant: endomycorrhizae and ectomycorrhizae.

The endomycorrhizae, commonly referred to as the "vasicular-arbuscular" type, are the most common mycorrhizal root symbionts. They occur in both hardwood and coniferous trees. Many of our commercial forest tree species have endomycorrhizae including coast redwood, giant sequoia, incense-cedar, western red cedar and Port-Orford cedar.

Endomycorrhizal fungi produce no external morphological changes in the roots. They colonize roots by penetrating the cell walls of the epidermis and then growing into the cortical cells of the roots. These infective hyphae may develop specialized absorbing or nutrient-exchanging structures called "arbuscules" in the cortical cells. They also form another structure called a vesicle whose function is not known.

The ectomycorrhizal fungi are less widely distributed. They occur primarily on members of the Pinaceae, Betulaceae and Fagaceae. These include most of the major commercial softwood-producing species except for coast redwood, giant sequoia, cedars and junipers.

Ectomycorrhizal fungi grow over the feeder root surface forming an external fungal mantel. Once the mantel is formed, hyphae grow intercellularly in the root cortex, forming the Hartig-net which may completely replace the middle lamellae between cortical cells. This Hartig-net is the major distinguishing feature of ectomycorrhizae. The ectomycorrhizae may appear as elaborate branched roots, bifurcate roots, simple unforked roots or nodular-like roots. Any or all of the above forms may exist in the same root system.

There is also a third type of mycorrhizae called ectendomycorrhizae. This type has the characteristics of both ectomycorrhizae and endomycorrhizae. Little is known about this mycorrhizal type.

BENEFITS OF MYCORRHIZAE

Mycorrhizae provide three major benefits to the host plant. They increase the efficiency of the root system protect roots against infection by root pathogenic fungi and help trees to survive in adverse soil environments.

Mycorrhizal plants have an increased absorptive surface area due to the hyphal network extending from the roots into the soil thus making them much more efficient in accumulating and using the nutrients available in the soil. Ectomycorrhizae can also absorb and store nitrogen, phosphorus, potassium and calcium in their fungus mantels, later releasing them to the host tree. They also have the ability to change complex organic substances into compounds that can be absorbed and utilized by the tree.

Ectomycorrhizae may protect the feeder roots of trees from certain diseases. The mantel tends to act as a barrier against infection and also produces some antibiotics which are active against disease-causing fungi. They also help trees to grow in soils that contain organic or inorganic toxins or that have extreme pH.

IMPACT ON NURSERY SEEDLINGS WHERE MYCORRHIZAL FUNGI ARE ABSENT

Mychorrhizal fungi are a natural part of the soil environment. However, in forest nurseries under intensive culture the land is fumigated prior to sowing the tree seed in the spring. This fumigation kills pathogenic soil fungi, cutworms and wireworms, nematodes, weed seeds and also mycorrhizal fungi. There is then a time lag before these fungi reestablish themselves uniformly throughout the seed-beds. This results in a patchy or spot infection of clumps of seedlings. The infected seedlings grow at a normal rate while the uninfected ones grow very slowly and become stunted. This differential growth often results in a mosaic pattern of stunted seedlings in which there are patches of normal size seedlings. This is not a problem if the seedlings are being grown for 2-0 outplanting because the uninfected seedlings become infected and catch up with the infected ones during the second growing season. However, if the seedlings are being grown for 1-0 outplanting many of the seedlings have to be discarded or held over and then lifted as 1 1/2-0 or 2-0 seedlings. These delays impact nursery operations as well as forest planning, site preparation and other regeneration plans. At Placerville Nursery, in 1978, 3MM 1-0 Jeffrey and ponderosa pine had to be held over for an extra growing season.

At Humboldt Nursery small, non-mycorrhizal (1"-3") Douglas-fir seedlings are attacked by a weak pathogen. This fungus would not be a problem if the seedlings grew 4" or taller the first growing season. Between 1970 and 1976, 6MM seedlings were lost to this disease of non-mycorrhizal seedlings.

At the present time studies are being conducted by government and private organizations to develop an operational method of reestablishing mycorrhizal fungi in nursery seed-beds. These studies are in the developmental and field-trial stages. If the field trials are successful some of the forest nursery mycorrhizal problems could be solved this year.

THE COOPERATIVE FOREST PEST DETECTION SURVEY is sponsored by the California Forest Pest Control Action Council. Detection of damage due to insects, diseases, animals, weather, chemicals, and air pollution should be reported on the Forest Pest Detection Report, form R5-5200-33, or by card or letter. The Pest Action Council encourages Federal, State, and private land managers and individuals to contribute to the Detection Survey by submitting damage reports and samples in the following manner.

Forest Service Personnel: Send detection reports through channels and mail all samples to the Regional Office -- USDA, Forest Service, Forest Insect and Disease Management Staff, 630 Sansome Street, San Francisco, California 94111.

State Personnel: Send all detection reports through channels and mail all samples to the CDF Headquarters - - California Department of Forestry, 1416 - 9th Street, Sacramento, California 95814.

Private Foresters and Individuals: Send insect and disease detection reports and damage samples to the CDF Headquarters - - California Department of Forestry, 1416 - 9th Street, Sacramento, California 95814.

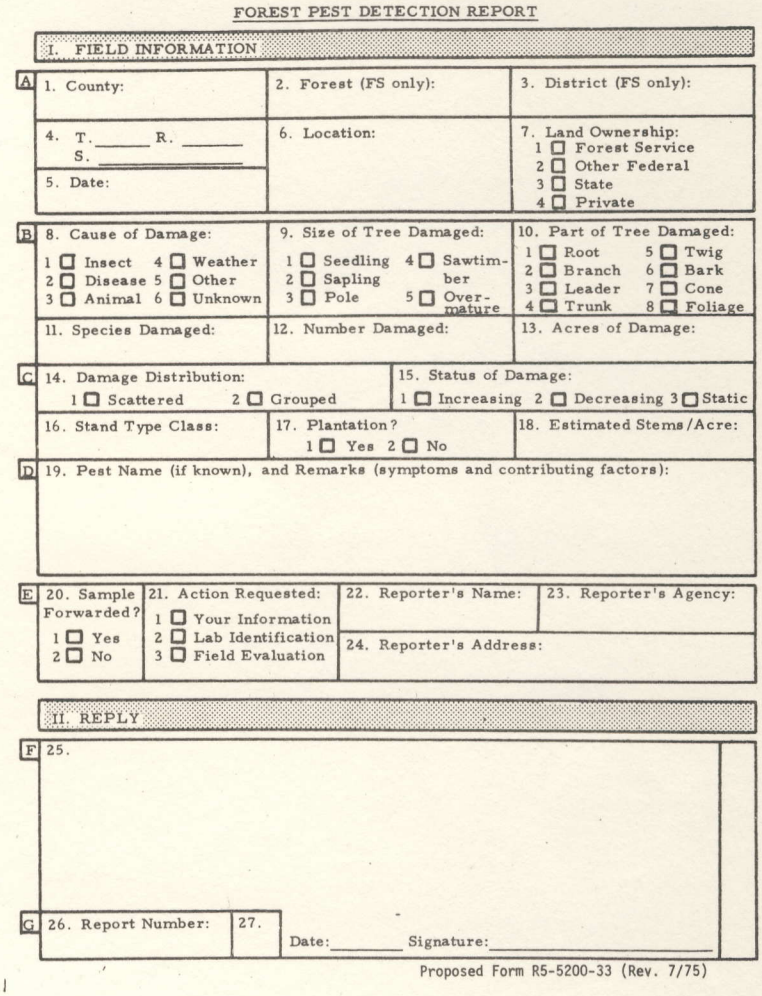
Please submit adequate damage samples with each detection report; send several samples illustrating the stages of damage and decline. Keep samples cool and ship them immediately after collection. Send samples in a screw-top mailing tube or other suitable container, and enclose the original or a copy of the detection report with the sample.

All detection reports will be acknowledged and evaluated by specialists concerned with damage caused by forest pests.

Additional copies of the Forest Pest Detection Report form are available from local offices of the Forest Service and the California Department of Forestry.

YOUR COOPERATION WITH THE CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL IN ASSISTING WITH THE COOPERATIVE FOREST PEST DETECTION SURVEY IS GREATLY NEEDED AND APPRECIATED.

FOREST PEST DETECTION REPORT. This Conditions Report is compiled from information recorded on this form by Federal, State, and private forest managers and individuals. The accuracy and completeness of the data reported here depends on the care with which people concerned with forests report incidents of damage caused by insects, diseases, animals, weather, chemicals, and air pollution. The form is available at local offices of the Forest Service, or from the California Department of Forestry.



FOREST PEST DETECTION REPORT

I. FIELD INFORMATION

A
1. County:
2. Forest (FS only):
3. District (FS only):
4. T._____ R._____ S._____
5. Date:
6. Location:
7. Land Ownership:
1 ☐ Forest Service
2 ☐ Other Federal
3 ☐ State
4 ☐ Private

B
8. Cause of Damage:
1 ☐ Insect 4 ☐ Weather
2 ☐ Disease 5 ☐ Other
3 ☐ Animal 6 ☐ Unknown
9. Size of Tree Damaged:
1 ☐ Seedling 4 ☐ Sawtimber
2 ☐ Sapling
3 ☐ Pole 5 ☐ Overmature
10. Part of Tree Damaged:
1 ☐ Root 5 ☐ Twig
2 ☐ Branch 6 ☐ Bark
3 ☐ Leader 7 ☐ Cone
4 ☐ Trunk 8 ☐ Foliage
11. Species Damaged:
12. Number Damaged:
13. Acres of Damage:

C
14. Damage Distribution:
1 ☐ Scattered 2 ☐ Grouped
15. Status of Damage:
1 ☐ Increasing 2 ☐ Decreasing 3 ☐ Static
16. Stand Type Class:
17. Plantation?
1 ☐ Yes 2 ☐ No
18. Estimated Stems/Acre:

D
19. Pest Name (if known), and Remarks (symptoms and contributing factors):

E
20. Sample Forwarded?
1 ☐ Yes
2 ☐ No
21. Action Requested:
1 ☐ Your Information
2 ☐ Lab Identification
3 ☐ Field Evaluation
22. Reporter's Name:
23. Reporter's Agency:
24. Reporter's Address:

II. REPLY

F
25.

G
26. Report Number:
27.
Date:_____ Signature:_____

Proposed Form R5-5200-33 (Rev. 7/75)